

WHAT IS CLAIMED IS:

1. A diene rubber composition comprising a diene elastomer, a reinforcing inorganic filler, and a coupling agent, said inorganic filler comprising at least one silica obtainable by a preparation process comprising the reaction of a silicate with an acidifying agent in order to obtain a suspension of silica, then separation and drying of this suspension,

wherein the reaction of the silicate with the acidifying agent comprises the following successive steps:

( $\alpha$ ) forming an aqueous stock having a pH of between 2 and 5,

( $\beta$ ) adding simultaneously the silicate and the acidifying agent to said stock, such that the pH thereof is maintained between 2 and 5,

( $\gamma$ ) stopping the addition of the acidifying agent while continuing the addition of silicate until a pH of between 7 and 10 is obtained,

( $\delta$ ) adding simultaneously silicate and acidifying agent to the aqueous stock, such that the pH is kept between 7 and 10,

( $\epsilon$ ) stopping the addition of the silicate while continuing the addition of the acidifying agent until a pH of less than 6 is obtained.

2. The composition according to Claim 1, wherein a maturation step is carried out between step ( $\gamma$ ) and step ( $\delta$ ).

3. The composition according to Claim 1, wherein a maturation step is carried out at the end of step ( $\epsilon$ ).

4. The composition according to Claim 1, wherein in step (ε) the addition of the silicate is stopped while continuing the addition of the acidifying agent until a pH of between 3 and 5.5 is obtained.
5. The composition according to Claim 1, wherein between step (γ) and step (δ), acidifying agent is added, the pH at the end of this addition being between 7 and 9.5.
6. The composition according to Claim 1, wherein the entire reaction of the silicate with the acidifying agent is carried out between 70 and 95°C.
7. The composition according to Claim 1, wherein the entire reaction of the silicate with the acidifying agent is carried out at a constant temperature.
8. The composition according to Claim 1, wherein step (α) further comprises adding acidifying agent to water to obtain a pH value of the aqueous stock thus formed of between 2 and 6.
9. The composition according to Claim 1, wherein step (α) further comprises adding acidifying agent to a water + silicate mixture so as to obtain a pH value of the aqueous stock thus formed of between 2 and 6.
10. The composition according to Claim 1, wherein step (α) further comprises adding acidifying agent to an aqueous stock containing silica particles preformed at a pH greater than 7, so as to obtain a pH value of the stock thus formed of between 2 and 6.
11. The composition according to Claim 1, wherein the drying is effected by means of spraying.

12. The composition according to Claim 1, wherein the separation of the suspension comprises filtration effected by means of a filter press.
13. The composition according to Claim 1, wherein the drying of the suspension is effected by means of a nozzle sprayer.
14. The composition according to Claim 1, wherein the separation of the suspension comprises filtration effected by means of a vacuum filter.
15. The composition according to Claim 1, wherein the drying of the suspension is effected by means of a turbine sprayer.
16. The composition according to Claim 1, wherein the silica has a BET specific surface area of between 45 and 400 m<sup>2</sup>/g, a CTAB specific surface area of between 40 and 380, and an average particle size (by mass), d<sub>w</sub>, of from 20 to 300 nm.
17. A diene rubber composition comprising a diene elastomer, a reinforcing inorganic filler, and a coupling agent, wherein said inorganic filler comprises a silica having the following features:
  - (a) a BET specific surface area between 45 and 400 m<sup>2</sup>/g;
  - (b) a CTAB specific surface area between 40 and 380 m<sup>2</sup>/g;
  - (c) an average particle size (by mass), d<sub>w</sub>, of 20 to 300 nm;
  - (d) a particle size distribution such that  $d_w \geq (16,500 / \text{CTAB}) - 30$ .
18. The composition according to claim 17, wherein the BET area is between 80 and 300 m<sup>2</sup>/g, and the CTAB area is between 70 and 280 m<sup>2</sup>/g.
19. A diene rubber composition comprising a diene elastomer, a reinforcing inorganic filler, and a coupling agent wherein said inorganic filler comprises a silica having the following features:

- (a) a BET specific surface area between 45 and 400 m<sup>2</sup>/g,
- (b) a CTAB specific surface area between 40 and 380 m<sup>2</sup>/g;
- (c) an average particle size (by mass), d<sub>w</sub>, of 20 to 300 nm;
- (d) a porosity which meets the criterion  $L / IF \geq -0.0025 \text{ CTAB} + 0.85$ .

20. The composition according to claim 19, wherein the BET area is between 80 and 300 m<sup>2</sup>/g, and the CTAB area is between 70 and 280 m<sup>2</sup>/g

21. A diene rubber composition comprising a diene elastomer, a reinforcing inorganic filler, and a coupling agent, wherein said inorganic filler comprises a silica having the following features:

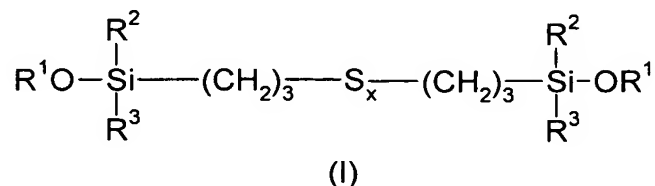
- (a) a BET specific surface area between 45 and 400 m<sup>2</sup>/g;
- (b) a CTAB specific surface area between 40 and 380 m<sup>2</sup>/g;
- (c) an average particle size (by mass), d<sub>w</sub>, of 20 to 300 nm;
- (d) an amount of silanols per unit of surface area,  $N_{\text{SiOH/nm}^2}$ ,  
 $N_{\text{SiOH/nm}^2} \leq -0.027 \text{ CTAB} + 10.5$ .

22. The composition according to claim 21, wherein the BET area is of between 80 and 300 m<sup>2</sup>/g, and the CTAB area is of between 70 and 280 m<sup>2</sup>/g.

23. A diene rubber composition comprising a diene elastomer, a reinforcing inorganic filler, and a coupling agent, wherein said inorganic filler comprises a silica having the following features:

- (a) a BET specific surface area between 45 and 400 m<sup>2</sup>/g;
- (b) a CTAB specific surface area between 40 and 380 m<sup>2</sup>/g;
- (c) an average particle size (by mass), d<sub>w</sub>, of 20 to 300 nm;
- (d) a particle size distribution such that  $d_w IF \geq (16,500 / \text{CTAB}) - 30$ ;
- (e) a porosity which meets the criterion  $L/IF \geq -0.0025 \text{ CTAB} + 0.85$ ;
- (f) an amount of silanols per unit of surface area  $N_{\text{SiOH/nm}^2}$ ;  
 $N_{\text{SiOH/nm}^2} \leq -0.027 \text{ CTAB} + 10.5$ .

24. The composition according to claim 23, wherein the BET area is of between 80 and 300 m<sup>2</sup>/g, and the CTAB area is of between 70 and 280 m<sup>2</sup>/g.
25. The composition according to Claim 23, wherein the silica has a disagglomeration rate,  $\alpha$ , measured by means of an ultrasound disagglomeration test in pulse mode (1 s ON, 1 s OFF), at 100% power of a 600 W ultrasound probe, of at least 0.0035  $\mu\text{m}^{-1}.\text{mn}^{-1}$ .
26. The composition according to Claim 23, wherein the BET area is of between 130 and 300 m<sup>2</sup>/g and the CTAB specific surface area is of between 120 and 280 m<sup>2</sup>/g.
27. The composition according to Claim 23, wherein the coupling agent is selected from polysulfurized alkoxy silanes of the formula:



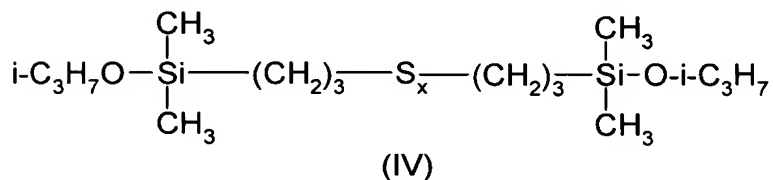
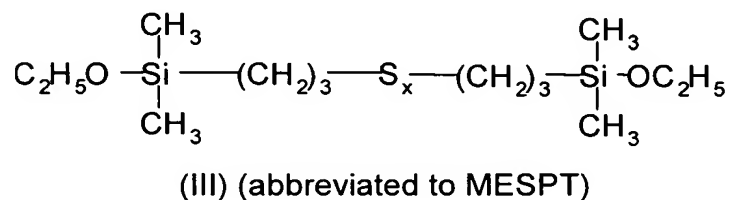
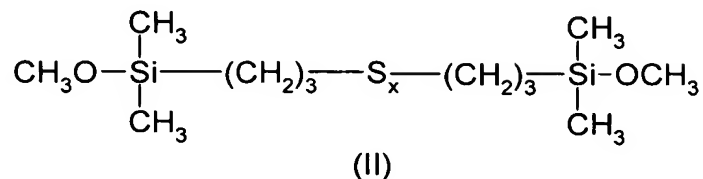
in which:

the symbols  $\text{R}^1$ , which may be identical or different, each represent a monovalent hydrocarbon group selected from alkyls, whether straight-chain or branched, having from 1 to 4 carbon atoms and alkoxyalkyls, whether straight-chain or branched, having from 2 to 8 carbon atoms;

the symbols  $\text{R}^2$  and  $\text{R}^3$ , which may be identical or different, each represent a monovalent hydrocarbon group selected from alkyls, which are straight-chain or branched, having from 1 to 6 carbon atoms and the phenyl radical;

x is an integer or fraction of between 3 and 5.

28. The composition according to Claim 27, wherein the coupling agent is /selected from those of formulae (II), (III) or (IV):



in which the symbol x is an integer or fractional number of between 3 and 5.

29. A process for the preparation of a diene rubber composition comprising a diene elastomer, a reinforcing inorganic filler, and a coupling agent, wherein said process comprises the following steps:

- i. incorporating in a diene elastomer, during a first stage referred to as "non-productive", a reinforcing filler and a coupling agent ;
- (ii) thermomechanically kneading the entire mixture in one or more stages, until a maximum temperature of between 110°C and 190°C is reached;
- iii. cooling the mixture to a temperature of less than 100°C;
- iv. then incorporating during a second step, referred to as "productive", a cross-linking or vulcanization system;

- v. kneading the entire mixture until a maximum temperature of less than 110°C is reached,

wherein said inorganic filler comprises a silica according to Claim 1.

- 30. A semi-finished rubber article for tires based on the diene rubber composition according to Claim 1.
- 31. A tire incorporating a semi-finished rubber article according to Claim 30.
- 32. A tire tread comprising a diene rubber composition according to Claim 1.
- 33. A tire incorporating a tread according to Claim 32.
- 34. The process of Claim 29, wherein said inorganic filler comprises a silica according to Claim 23.
- 35. A semi-finished rubber article for tires based on the diene rubber composition according to Claim 23.
- 36. A tire tread comprising a diene rubber composition according to Claim 23.
- 37. A tire incorporating a tread according to Claim 36.
- 38. A tire incorporating a semi-finished rubber article according to Claim 35.